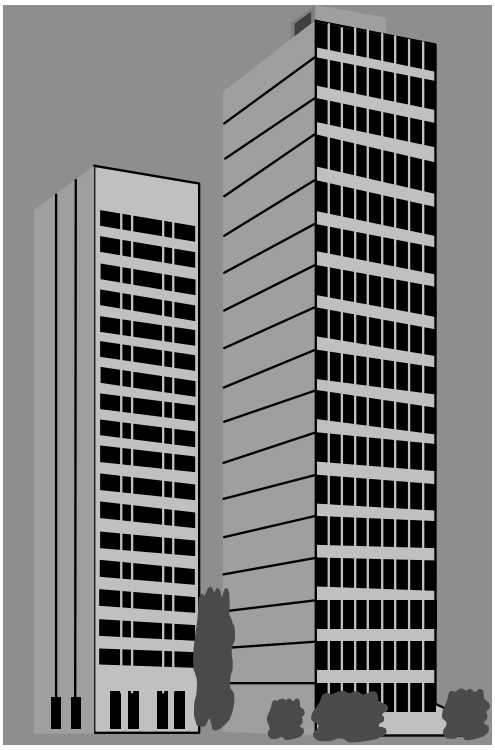
Appendix IV

Indoor Air Quality Assessment
MCCT
Middlesex County Sheriff's Office (Floor 16 and 17)
40 Thorndike Street
Cambridge, Massachusetts

December 1999

INDOOR AIR QUALITY ASSESSMENT

Middlesex County Sheriff's Office and Prisoner Holding Cells
Middlesex County Court Building
Floors 17 – 20
Cambridge, MA



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Bureau of Environmental Health Assessment
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Background/Introduction

In response to a request from Rosa Chavez, facility manager of the Cambridge Court Complex, an indoor air quality assessment was done at the Middlesex County Sheriff's Office (MCSO) and lock up facilities on the 17th through 20th floors of the Middlesex County Courthouse (MCC), 40 Thorndike Street, Cambridge, Massachusetts. This assessment was conducted by the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA). Concerns about indoor air quality in these areas were expressed.

A visit was made to this location by Cory Holmes, Environmental Analyst of the Emergency Response/Indoor Air Quality (ER/IAQ) Program. Mr. Holmes was accompanied by Suzan Donahue, Research Assistant, BEHA and Ms. Rosa Chavez. The remainder of the building will be addressed in a separate report. BEHA staff previously evaluated the Cambridge District Court (CDC) on the 13th, 14th and 15th floors (MDPH, 1999a); the CDC Lock Up of the 14th floor (MDPH, 1999b); Cambridge Superior Court grand jury area on the 4th floor (MDPH, 1999c) and the Middlesex County Sheriff's Office on the 17th floor (MDPH, 1999d).

The MCSO is a secure facility that consists of two clusters of offices on the east and west side of this floor. Each office cluster is separated by the waiting room and the lock up system control room in the center of the floor. Electronically operated doors control entrance into employee areas of this floor. Unlike other floors in this building, a number of exterior offices have openable windows. The infirmary and isolation segregation area is located on the 17th floor. Inmates are confined on the 18th – 20th floors. A cafeteria, kitchen and the chapel are located in the 19th floor.

Methods

Air tests for carbon monoxide, carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551.

Results

The MCSO has approximately 20 employees and approximately 50-100 inmates. The tests were taken under normal operating conditions. Test results appear in Tables 1-5.

Discussion

Ventilation

It can be seen from the tables that carbon dioxide levels were below 800 parts per million parts of air [ppm] in all but two areas sampled. These carbon dioxide levels are indicative of an adequate fresh air supply in most areas of this section of the building. It should also be noted that several of these areas had low occupancy and/or open windows, which can greatly contribute to reduced carbon dioxide levels.

Ventilation is provided by heating, ventilation and air-conditioning (HVAC) units located in mechanical rooms on each floor of the MCC. Fresh air is supplied by ceiling mounted air diffusers (see Picture 1). Vents in the 18th floor dormitory were found blocked with tissue paper (see Picture 2). These vents must remain unblocked in order to function as designed. Exhaust ventilation is provided by ducted, return air vents that are connected to an air-handling unit (see Picture 3). General exhaust vents were operating during this evaluation. These vents must remain unblocked in order to function as

designed. Several exhaust vents in the shower area on the 18th floor were not drawing air. Exhaust ventilation is necessary in order to remove moisture and to prevent odors from migrating into adjacent areas.

In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air. The date of the last servicing and balancing of these systems was not available at the time of the visit.

The Massachusetts Building Code requires a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room for guard stations (20 cfm for cells) (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact

that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches.

Temperature readings were within a range of 66^{o} to 78^{o} F, which was below the BEHA recommended comfort range in some areas. The BEHA recommends that indoor air temperatures be maintained in a range of 70^{o} to 78^{o} F in order to provide for the comfort of building occupants. While temperature readings outside the recommended range are generally not a health concern, increased temperature can affect the relative humidity in a building. Unlike the lower floors of this building, a number of offices on exterior walls have opening windows. Reports of cold temperatures in these offices in the winter were attributed to their design. The louvered-style windows consist of a number of overlapping glass panes that can be opened at an angle using a crank system. While openable, these windows do not provide an airtight seal to prevent outdoor air penetration. As a stop gap measure, sheets of plexiglass are installed over these windows, as reported by building occupants.

The relative humidity in this building was within the BEHA recommended comfort range of all areas sampled. Relative humidity measurements ranged from 27 to 36 percent. The BEHA recommends that indoor air relative humidity is comfortable in a range of 40 to 60 percent. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

A number of rooms have water-damaged walls and ceiling tiles which can indicate leaks from the plumbing system and or windows. A number of areas are reported by building occupants to have active leaks (see Tables). These floors (17-20) have a history of water damaged building materials due to plumbing failure due to the presence of commodes and sinks located in patient cells. Reportedly these fixtures are often tampered with by occupants to intentionally cause flooding and subsequent damage. Water-damaged ceiling tiles and other porous materials (e.g., carpeting, wallboard) can provide a medium for mold and mildew growth and should be replaced after a water leak is discovered.

Several offices contained a number of plants. Several planters were colonized by mold. Plant soil and drip pans can provide a source of mold growth. Over-watering of plants should be avoided and drip pans should be inspected periodically for mold growth. Plants should have drip pans to prevent wetting and subsequent mold colonization of window frames. Plants should also be located away from ventilation sources to prevent the aerosolization of mold, dirt and pollen.

Some areas had water coolers on carpets. Water spillage or overflow of cooler catch basins can result in the wetting of the carpet. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that carpeting be dried with fans and heating within 24 hours of becoming wet (ACGIH, 1989). If carpets are not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed.

The sheriff's office reception area contained a humidifier. Humidifiers contain standing water, which can become stagnant, provide a medium for bacterial and mold growth and be a source of unpleasant odors.

As stated previously, many of the windows have been damaged and/or do not close properly. Repairs of window leaks are necessary to prevent further water penetration. Repeated water damage can result in mold colonization of window frames, curtains and items stored on or near windowsills.

Other Concerns

Several conditions that can potentially affect indoor air quality were also identified. A number of areas had missing ceiling tiles and/or open utility holes. Missing ceiling tiles and utility holes can provide an egress for dirt, dust, odors and particulate matter between rooms and floors. These materials can be irritating for certain individuals.

Several rooms contained dry erase boards and dry erase markers. Materials such as dry erase markers and dry erase board cleaners may contain VOCs, (e.g., methyl isobutyl ketone, n-butyl acetate and butyl-cellusolve) (Sanford, 1999), which can be irritating to the eyes, nose and throat.

Conclusions/Recommendations

In view of the findings at the time of this visit, the following recommendations are made:

1. Implement recommendations listed in previous BEHA correspondence (MDPH, 2000).

2. Identify the source of plumbing leaks damaging ceiling tiles and repair. Once leaks are repaired, examine nonporous surfaces above the ceiling and disinfect with an appropriate antimicrobial.
3. Repair exhaust vents in the shower room on the 18th floor.
4. Remove tissue paper from the air diffusers in the 18th floor dormitory.
5. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all non-porous surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
6. Move plants away from air diffusers and ensure drip pans are placed underneath plants. Examine plants for mold growth in water catch basins. Disinfect water catch basins if necessary.
7. Clean humidifiers and dehumidifiers regularly and maintain as per the manufacturer's instructions to prevent microbial growth and/or unpleasant odors.
8. Replace missing ceiling tiles and fill utility holes to prevent the egress of dirt, dust, odors and particulate matter between rooms and floors.
9. Examine the feasibility of repairing/replacing windows.

References

BOCA. , 1993. The BOCA National Mechanical Code/1993. 8th ed. Building Officials and Code Administrators International, Inc., Country Club Hill, IL. Section M-308.1.1.

MDPH. 1999a. Indoor Air Quality Assessment Cambridge District Court, Middlesex County Courthouse, 13th, 14th and 15th Floors, Cambridge, Massachusetts. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

MDPH. 1999b. Indoor Air Quality Assessment Cambridge Superior Court Grand Jury Room, Middlesex County Courthouse, 3rd Floor, 40 Thorndike Street, Cambridge, Massachusetts. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

MDPH. 1999c. Indoor Air Quality Assessment Cambridge District Court, Middlesex County Courthouse, 14th Floor Holding Cells Control Room Areas, Cambridge, Massachusetts. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

MDPH. 1999d. Indoor Air Quality Assessment Cambridge District Court, Middlesex County Courthouse, 17th Floor Middlesex County Sheriff's Office, Cambridge, Massachusetts. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R. 1910.1000 Table Z-1-A.

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SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

TABLE 1

Indoor Air Test Results – Middlesex County Sheriff's Department, 17th Floor
Middlesex County Jail, Cambridge, MA August 11, 1999

Remarks	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Outside (Background)	405	73	69					
Sheriff's Office	450	69	62	0	no	yes	yes	door open
Sheriff's Reception Area	444	69	62	1	no	yes	yes	door open
Accounting Office	432	70	62	0	no	yes	yes	
Ssuperintendent's Outer Office	430	74	56	0	yes	yes	yes	1 supply blocked by fiberglass, door open
Control Room	521	73	57	2	no	yes	yes	
Control Room Restroom						no	yes	exhaust off
17th Floor Lobby	427	72	60	1	no	yes	yes	

*** ppm = parts per million parts of air**
CT = water-damaged ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%